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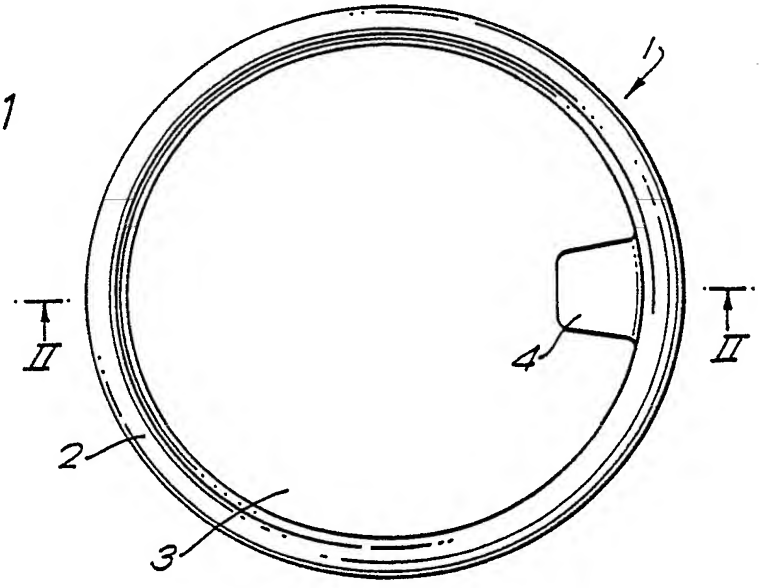
(54) **Container closure.**

(57) A container closure has a diaphragm (3) supported by a ring (2). The diaphragm (3) has a pull tab (4) for peeling the diaphragm (3) from the supporting ring (2). The supporting ring (2) has a peripheral formation for securing the ring to a container body and extending radially inwardly therefrom an annular ledge having inner and outer parts (8), (9), axially spaced by a step portion (10). The inner part (9) extends into an annular curl (11) and then back on itself to overlie the inner annular part (9). In this way, the cut edge (112) of the annular blank from which the ring is formed is protected from the atmosphere and from the contents of the can. The invention provides a method and apparatus for manufacturing such a closure.

FIG. 1



EP 0 408 268 A2

CONTAINER CLOSURE

This invention relates to closures for cans or like containers, and more particularly to closures of a kind comprising a ring portion adapted for attachment to a container body and having a diaphragm sealingly fixed to the ring to complete the closure.

British Patent No. 1274542 (Sandherr) describes containers having closures comprising a ring and a diaphragm adhered to the ring by an adhesive that permits peeling of the diaphragm from the ring to give access to the contents of the container. In one embodiment Sandherr provides a ring having a peripheral portion adapted for attachment to a container body, an annular plug portion extending from the peripheral portion to enter the container body, a flat annulus extending radially inwards from the plug portion and a frustoconical annulus depending from the interior of the flat annulus to terminate at the container body. The diaphragm is peripherally adhered to the flat annulus and spans the ring to serve as a closure removable by a peeling action. Whilst the frustoconical annulus serves to guide powder products out of the container, its terminal edge is inside the container and therefore at risk of corrosion by any aggressive substance packed in the container.

In a second embodiment Sandherr describes a ring having a peripheral portion, an annular plug, portion depending from the peripheral portion, a frustoconical annulus extending upwardly and inwardly from the annular plug portion and a flat annulus extending radially outwards from the frustoconical annulus. The diaphragm is adhered to the flat annulus, the free edge of which is at risk of atmospheric corrosion.

British Patent No. 2022474B describes a process for making peripheral rings for the end of cans. These rings are cut from a lacquered sheet and formed with an inwardly extending portion whose inner part is turned back on itself away from the interior of the can to form an annular level flange overlying the outer part of the inwardly extending portion. A diaphragm with a tearback tab is bonded to this flange. In this case too, the cut edge of the ring is open to the atmosphere and thus at risk from atmospheric corrosion.

EPA-A-090957 describes a closure in which the cut edge is folded back against a step in an annular portion of the ring. The folded back portion provides a bonding zone for the diaphragm, in addition to the bonding zone provided by the annular portion. The cut edge is thus sealed from the atmosphere.

Apart from providing a closure for a can which does not have cut edges open to the atmosphere, there is a need to provide a closure in which the diaphragm is sealed to the ring by a bond which can withstand the temperatures (up to 135 ° C and typically 121 ° C) required to pasteurise products sealed within the can.

It would be desirable to produce such a closure simply and in a cost effective manner.

According to one aspect of the present invention there is provided a method of manufacturing a supporting ring comprising:-

supporting sheet metal on ah outer support of a lower die, said outer support providing a cutting edge;

bringing a cooperating cutting edge into contact with the sheet metal to cut a blank from the metal and to hold the cut edge of the blank;

punching a central aperture in the blank while urging the periphery of the blank into contact with stamping surfaces of the lower die thereby to commence formation of a stepped annular ledge terminating in an annular trough and an upstanding annular wall; and

on completion of said formation, folding the upstanding annular wall so as to cause the free edge thereof to overlie the inner part of the stepped annular ledge.

This method, which involves the step of punching a central aperture while commencing formation of the periphery of the blank, enables a ring to be made in a simple procedure requiring only two forming operations. In contrast to earlier methods, where the central aperture is punched after wholly or partially forming the periphery of the blank, in the present invention the central aperture is punched while the periphery is being formed which provides the central upstanding wall without the need for further steps. Furthermore, in subsequent forming of the periphery to completion, metal can be drawn not only from the outer cut edge of the blank but also from the central cut edge. This reduces wastage of metal from the sheet from which the blank is cut.

A method of manufacturing a closure comprises the additional step of bonding a diaphragm to the ring at concentric bonding zones presented by the outer part of the stepped annular ledge and the portion of the upstanding annular wall which has been folded to overlie the inner part of the stepped annular ledge.

If desired, the diaphragm has a pull lug extending from its periphery and the bond at the bonding zones between the diaphragm and the ring permits removal of the diaphragm by a peeling action. The diaphragm may be bonded to the ring by adhesive. Alternatively, the diaphragm may be cut from a laminate of common metal and a polymeric film bonded by application of heat and pressure to the diaphragm to seal the diaphragm to the ring at the bonding zone.

In another case, the ring may be stamped from a laminate of common metal and a polymeric film, or prelacquered common metal, and the diaphragm is bonded to said film or lacquered surfaces at the bonding zones. Preferably, the diaphragm is cut from a laminate of aluminium and a polymeric film that will adhere to a receptive surface coating on a ring stamped from precoated tinplate or electrochrome coated steel (called TFS).

The invention provides in another aspect apparatus for manufacturing a supporting ring for a container closure the apparatus comprising circular upper and lower dies having two sets of cooperating cutting edges, the sets being spaced apart radially so as to cut an annular blank from sheet metal supported by the lower die, and between said sets of cutting edges a set of cooperating stamping surfaces for stamping the annular blank to form a stepped annular ledge terminating in an upstanding annular wall and the lower die having a draw portion over which can be drawn the annular blank to form a peripheral formation.

The invention also provides a closure for a can or like container comprising a ring for attachment to a container body, the ring comprising a peripheral formation adapted for engagement with a container body, and an annular flange portion extending radially inwardly from the peripheral formation to support a diaphragm bonded to the ring, wherein the annular flange portion comprises a level annular region and an annular curl extending inwardly from the level annular region and turned back on itself to define the opening of the ring and to overlie the level annular region and to present a bonding zone for the disphragm, the said level annular region being spaced radially from the peripheral formation by a second, outer annular region which is axially spaced from the inner annular region by a step portion so as to present an outer bonding zone for the diaphragm concentric with the first-mentioned, inner, bonding zone.

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is a plan view of a closure comprising a ring and a diaphragm;

Figure 2 is a sectional view of the closure of Figure 1 on line II-II in Figure 1;

Figure 3 is an enlarged fragmentary section through the closure of Figures 1 and 2;

Figure 4 is an enlarged fragmentary section through a second embodiment of the closure, also showing heat sealing tools;

Figure 5 is an enlarged fragmentary section through the ring of Figures 1 to 3 after double seaming to a metal container body;

Figure 6 is an enlarged fragmentary section through a third embodiment of the ring after attachment to a container body of spirally wound paperboard;

Figure 7 is an enlarged fragmentary section through a fourth embodiment of the ring when double seamed to a container and closed by a diaphragm inside the container and covered by a replaceable plug lid;

Figures 8a to 8f show apparatus for manufacturing closures;

Figure 9 is an enlarged fragmentary section of the annular flange portion of the ring during manufacture of the closure;

Figure 10 is a cross section through a closure in which the diaphragm is reinforced; and

Figure 11 shows a section through the ring, illustrating the curl dimensions.

Referring to Figure 1, a closure 1 comprises a ring 2 and a diaphragm 3 secured to the ring 2. The ring 2 is stamped from a common sheet metal such as tin plate or electrochrome coated steel (called TFS in the trade), typically of about 0.26mm thickness, or aluminium alloy sheet. Preferably, the ring surfaces to which the diaphragm is adhered are coated with a protective coating such as an epoxy phenolic lacquer or other polymeric film.

The diaphragm 3 has been cut from a thin sheet material such as an aluminium foil or laminate of aluminium foil/polymeric film or a laminate of polymeric films having suitable barrier properties. A printed paper layer may be included in the laminates to permit presentation of useful indicia. The rings may be made from prelacquered sheet metal or a laminate of sheet metal and a polymeric film. Particularly suitable laminates are those manufactured by CMB Foodcan plc under the Trade Mark METPOLAM. The following combinations of materials are appropriate:

Ring Coating		Diaphragm	
Internal	External	Substrate	Coating (film)
PP laminate	PP laminate	Aluminium	EVA
"	"	"	HDPE
"	PET	Aluminium	Heat seal lacquer
Epoxy phenolic with PP dispersion	Epoxy phenolic with PP dispersion	"	EVA
"	"	"	PP Copolymer
PP dispersion lacquer	PP dispersion lacquer	"	"
Any of above	Any of above	"	Polybutylene
PET	PET	Aluminium	Heat seal lacquer

PP is polypropylene; EVA is Ethylene vinylacetate; HDPE is high density polyethylene; PET is polyethylene terephthalate.

Figure 2 serves to show that the diaphragm 3 spans the ring 2 to which it is peripherally attached. As shown in Figures 1 and 2 the diaphragm has a pull tab 4 joining the periphery of the diaphragm at a fold line 4a. The pull tab is used to apply a peeling mode of force to remove the diaphragm 3 from the ring 2.

Figure 3 shows the ring 2 and its connection with the diaphragm 3 in more detail. The ring 2 comprises a peripheral formation adapted for engagement with a container body and including a flange 6, sometimes called a "cover hook", adapted for double seaming to a can body, an annular wall 7 depending from the inner periphery of the peripheral flange 6, and an annular flange portion extending radially inwards from the wall 7 to support the diaphragm 3. The annular flange portion comprises a first flat annulus 8 extending inwards from the chuck wall 7 and providing an outer annular region, a second flat annulus 9 surrounded by the first flat annulus 8 to provide an inner annular region and offset from said first flat annulus 8 by a step portion 10, and an annular curl 11 extending inwardly from the inner periphery of the second flat annulus 9 to turn back on itself to define the mouth of the ring and thereafter terminating as a third flat annulus 12 which lies over the second flat annulus 9. The diaphragm 3 is sealingly bonded by adhesive at an outer bond zone 5A to the upper surface of the first annulus 8 and by adhesive at an inner bond zone 5B to the upper surface of the third annulus 12 so that the free edge 112 of the third annulus 12 is totally enclosed from atmospheric or product attack.

In Figure 3 it can be seen that the step portion 10 holds the second annulus 12 at a distance, measured at the central axis of the ring, of about one metal thickness so that the top surfaces of the first annulus 8 and third annulus 12 are substantially flush. Therefore, no bending of the diaphragm material is required to achieve a seal with both annulii.

Various adhesives may be used at the bond zones 5A and 5B. For example, if a strong bond is required, a maleic anhydride modified polypropylene adhesive may be used. If however, a peel bond is required, an adhesive such as polymers of acrylic resin could be used. The outer bond zone 5A is typically 1mm wide and the inner bond zone 5B is typically 2mm wide but these dimensions are not critical relative to each other.

Figure 4 shows a second embodiment of the closure 13 in which a ring 14 has been stamped from a laminate of common sheet metal and a polymeric film on both major surfaces of the sheet metal. For example, a laminate comprising an outer layer 15 of polypropylene a middle layer 16 of electrochrome coated steel and an inner layer 17 of polypropylene may be used. The diaphragm 3 could then be made of a laminate of polypropylene 18 and aluminium foil 19 which may be decorated or printed on the outside. Heat sealing of the layer 18 of the diaphragm and to the layer 15 of the ring is achieved by supporting the ring in a lower tool 20 and applying a heated tool 21 to the top surface of the diaphragm. It will be noticed that the metal of the flat annulii 8, 9 and 12 is firmly supported to prevent any distortion of the diaphragm material. Alternative laminates include for example metal sheet and a film of polybutylene or polyethylene terephthalate.

Figure 5 shows the closure 1 of Figures 1, 2 and 3 after attachment to a can body 22 by means of a double seam 23. The second embodiment of the closure, denoted 13 in Figure 4, can also be attached to a can body in like manner.

However, as shown in Figure 6 the closure may be modified by provision of a modified peripheral flange to permit attachment to a container body 25, having a fibrous wall 27 made of spirally wound paperboard. Figure 6 shows such a modified closure 24 having a peripheral flange 26 crimped onto the fibrous wall 27.

It is intended that the embodiment described in Figures 1 to 5 will be used primarily on containers used for packing aseptically packed products or thermally processed paste-like substances such as pate or dog food. The diaphragm serves as a primary hermetic seal to the container.

However, it is traditional in the packing of dry goods, such as gravy granules or milk powders to use closures comprising a ring closed by a lever plug lid spanned by a diaphragm inside the container - usually held in place by the double seam. To this end, another embodiment of the invention provides, as shown in Figure 7, a closure 28 having a ring 29, a diaphragm 30 inside the container 31, and a plug lid 32 to serve as a useful reclosure after the diaphragm 30 has been cut open. In Figure 7 the ring comprises a first flat annulus 8A, a second flat annulus 9A which is held outwardly offset from the first flat annulus 8A, and a third flat annulus 12A produced by an annular curl 11A as described above. The first annulus 8A is offset from the second annulus 9A so that the third flat annulus 12A and first flat annulus present flush surfaces to the diaphragm 30 for adhesion or fusion as discussed above. This embodiment differs from those described above in that the annular curl 11A is upstanding above the diaphragm 30 which is then secured to the underside of the annuli 8A, 12A.

Figure 8a shows a tool set 40 comprising upper and lower dies 42, 44 for manufacturing a ring as described above. The upper die 42 comprises a component providing an annular cutting punch 60, a stamping punch 64 and a central cutting punch 66. A holding ring 62 is moveable relative to this component and is located between the cutting punch 60 and stamping punch 64. The lower die 44 comprises an outer cutting ring 68, an annular trough 70, a draw die 72, a stamping die 74 and an inner cutting ring 76. The tool also comprises a spring loaded support 61 against which bears the cutting punch 60.

Reference will now be made to Figures 8a to 8f to describe a process for manufacturing a closure as described above. Figure 8a shows the first tool set 40 comprising upper and lower dies 42, 44. The lower die supports on its outer and inner cutting rings 68, 76 a metal sheet 46 which is to form the ring of the closure. As the upper die is lowered the annular cutting punch 60 bears against the spring loaded support member 61 and cooperates with the outer cutting ring 68 to cut the outer edge of the blank which is to form the ring. The cut edge is held between the punch 60 and the support member 61 and is drawn over the draw die 72 to form the peripheral flange 6. The stamping punch 64 has an inner annular portion 65 which bears against the metal sheet 46 as the inner cutting ring 76 cooperates with the central punch 66 to cut an annular blank from the metal sheet (Figure 8b). In this way, formation of the blank periphery commences. The central part 48 is discarded. The upper die 42 is lowered further as shown in Figure 8c so that the sheet metal is in contact with salient surfaces of the stamping punch 64 and stamping die 74. The annular cutting punch 60 and stamping punch 66 are lowered still further so that the stamping punch forms with the stamping die 74 by stamping from the annular blank a component having a peripheral channel (which will form the peripheral flange 6 of the ring), an annular wall 7 depending from the peripheral flange 6, a stepped annular ledge providing the first and second annuli 8, 9 and the step portion 10 and a trough portion 11 which supports an upstanding central annular wall 12. Although this has been described as a series of steps occurring gradually, in practice the above described process is carried out in a single punch operation of the upper tool 42, taking no more than 0.2s. The first tool set applies initially no holding restraint for the annular blank. Peripheral restraint arises at the bend radii of the peripheral face of the draw die 72 and of the cutting ring 76 which cuts the blank. Also, in contrast to known ring manufacturing methods, the blank is cut prior to any shape forming steps. The holding ring 62 is then sprung downwardly to release the shaped annular blank from the upper tool 42. The shaped annular blank is then transferred to a second tool set as shown in Figure 8e. The lower tool takes the same form as the lower tool of the first tool set but the upper tool comprises a central punch 56 and a holding ring 62. As shown in Figure 8e, the peripheral flange portion 6 is held between the holding ring 62 and the draw die 72. A central punch 56 enters the annular wall 12 to fold that wall to form an outwardly directed curl 11 of which the raw edge terminates at the step portion 10. Finally a diaphragm is bonded to the annular blank by heat sealing.

Figure 9 illustrates how the curl 11 may terminate in a portion at a slight angle A to the surface of the step portion 10. In this case the material for the diaphragm is chosen to tolerate stretch to drape over the angled portion of the curl.

Finally, Figure 10 shows how the diaphragm 3 may be reinforced against abuse by bonding thereto the central part 48 cut during manufacture of the ring 2 with its periphery having been curled.

Figure 11 illustrates the curl radii, where $r_1 = r_2 = 1.2$mm and $r_3 = 0.6$mm. The curl is continuous, thus minimising the strain within the metal as it is formed.

Claims

1. A method of manufacturing a supporting ring comprising:-
supporting sheet metal on an outer support of a lower die, said outer support providing a cutting edge;
bringing a cooperating cutting edge into contact with the sheet metal to cut a blank from the metal and to hold the cut edge of the blank;
punching a central aperture in the blank while urging the periphery of the blank into contact with stamping surfaces of the lower die thereby to commence formation of a stepped annular ledge terminating in an annular trough and an upstanding annular wall; and
on completion of said formation, folding the upstanding annular wall so as to cause the free edge thereof to overlie the inner part of the stepped annular ledge.

2. A method of manufacturing a closure for a container comprising manufacturing a ring in accordance with the method of claim 1 and then bonding a diaphragm to the ring at concentric bonding zones presented by the outer part of the stepped annular ledge and the portion of the upstanding annular wall which has been folded to overlie the inner part of the stepped annular ledge.

3. A method as claimed in claim 2 in which the bonding is effected by heat sealing.

4. Apparatus for manufacturing a supporting ring for a container closure the apparatus comprising circular upper and lower dies having two sets of cooperating cutting edges, the sets being spaced apart radially so as to cut an annular blank from sheet metal supported by the lower die, and between said sets of cutting edges a set of cooperating stamping surfaces for stamping the annular blank to form a stepped annular ledge terminating in an upstanding annular wall and the lower die having a draw portion over which can be drawn the annular blank to form a peripheral formation.

5. Apparatus for manufacturing a supporting ring of a closure said apparatus comprising; in a first tool set having a top tool and a bottom tool movable towards and away from each other; a top tool comprising a cutting punch (60), a holding ring (62) within the cutting punch, and a stamping punch (64) within the holding ring and central cutting punch portion (66); and a bottom tool comprising a cutting ring (68) to cooperate with the cutting punch (60), a spring loader annular support (61) to cooperate with an end face of said cutting punch (60), a stamping die (74) axially aligned with cooperating surface of the stamping punch (64), said stamping die including an inner cutting ring (74) to cooperate with said central cutting punch portion; to make when the tools are closed a component comprising a peripheral flange, a frustoconical wall dependent from the interior of the flange, a first flat annulus extending inwards from the wall to a step portion (10) which holds a second flat annulus in offset relationship to the first flat annulus, and a cylindrical portion joined to said second annulus by a trough portion; and in a second tool set a bottom tool has means to support the component and a top tool comprises a holding ring to clamp the peripheral flange against the bottom tool and therein a punch (56) having a profiled surface to curl the free edge of the cylindrical portion of the component to overlap the second flat annulus.

6. A closure for a can or like container comprising a ring for attachment to a container body, manufactured according to any of claims 1 to 3, the ring comprising a peripheral formation adapted for engagement with a container body, and an annular flange portion extending radially inwardly from the peripheral formation to support a diaphragm bonded to the ring, wherein the annular flange portion comprises a level annular region and an annular curl extending inwardly from the level annular region and turned back on itself to define the opening of the ring and to overlie the level annular region and to present a bonding zone for the disphragm, the said level annular region being spaced radially from the peripheral formation by a second, outer annular region which is axially spaced from the inner annular region by a step portion so as to present an outer bonding zone for the diaphragm concentric with the first-mentioned, inner, bonding zone.

7. A closure according to claim 6 wherein a diaphragm is bonded by heat sealable adhesive at the bonding zones.

8. A closure according to claim 6 wherein a diaphragm is formed from a laminate of common metal and a polymeric film and is bonded by application of heat and pressure to the ring to seal the diaphragm at the bonding zones.

9. A closure according to claim 6 wherein the ring is stamped from a laminate of common metal and a polymeric film or a prelacquered common metal and the diaphragm is bonded to the film or lacquered surfaces.

FIG.1

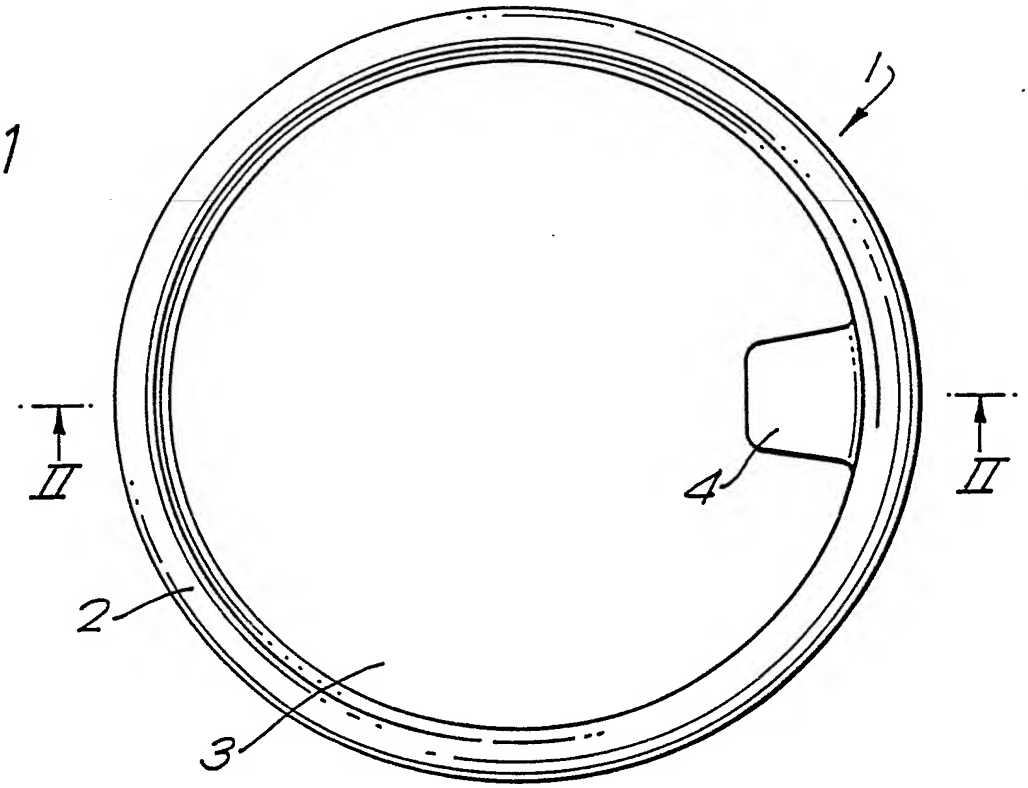


FIG.2

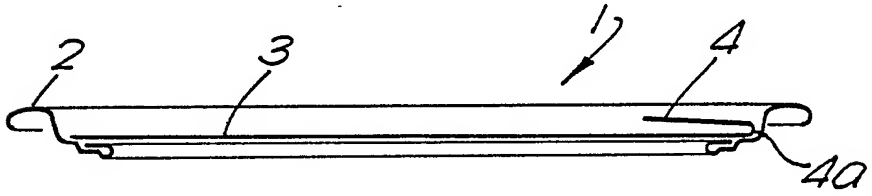
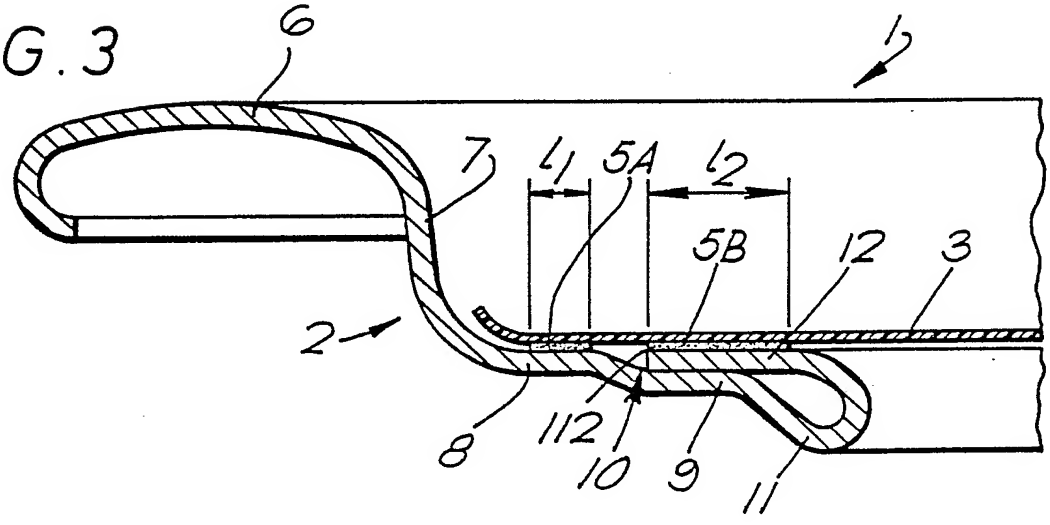


FIG.3



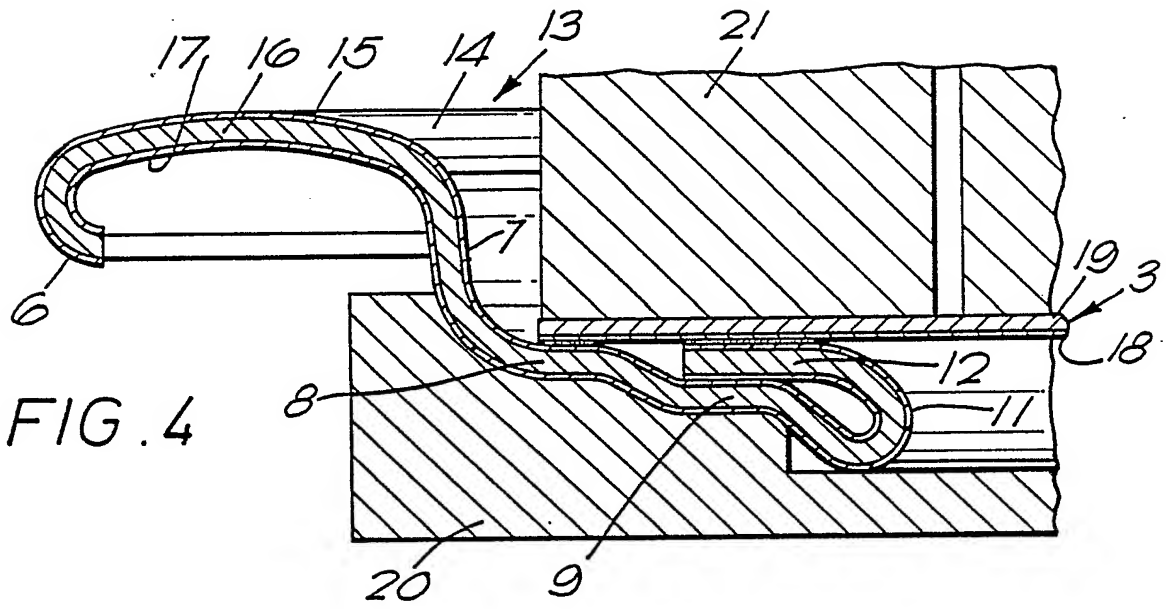


FIG. 4

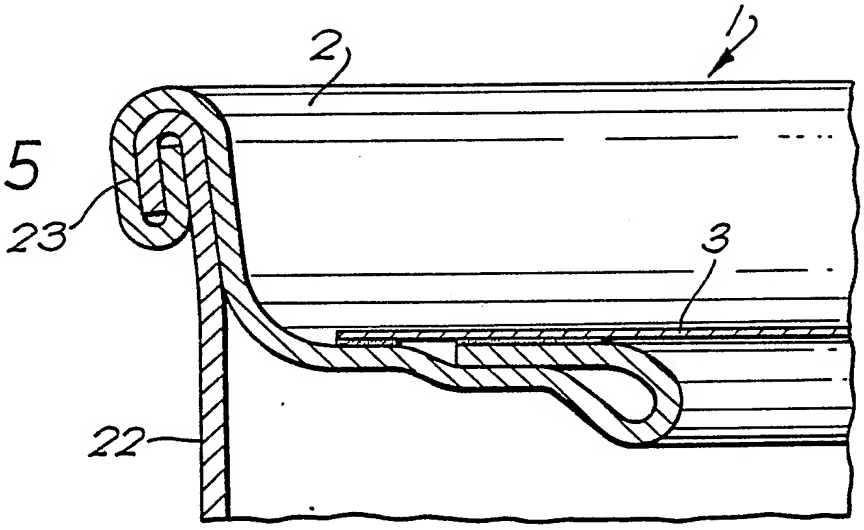


FIG. 5

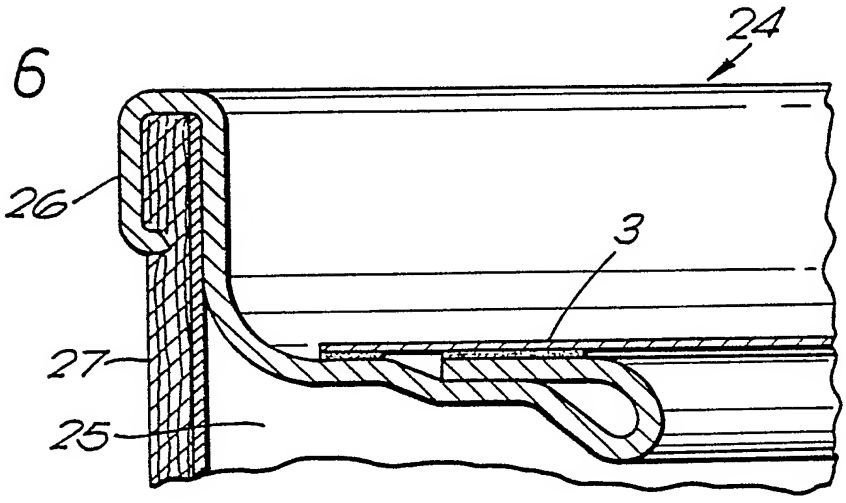


FIG. 6

FIG. 7

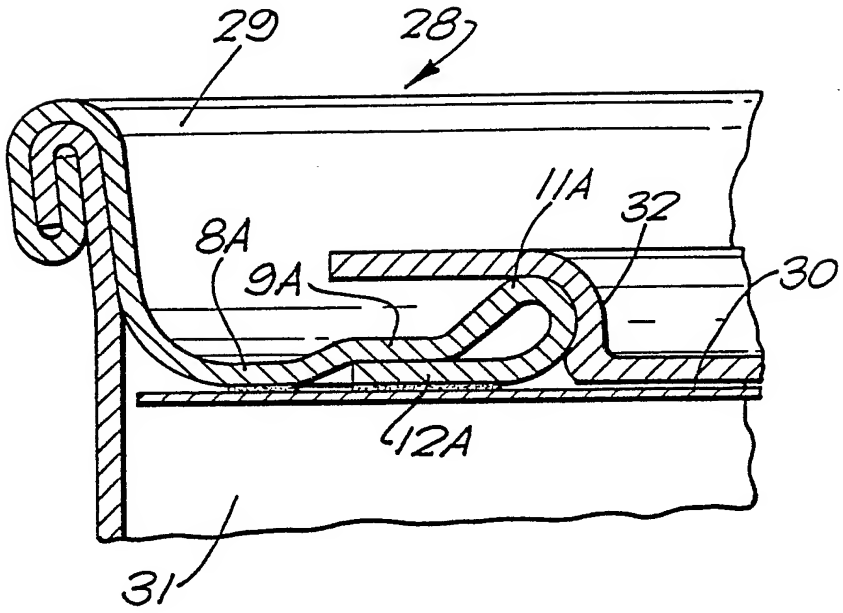


FIG. 9

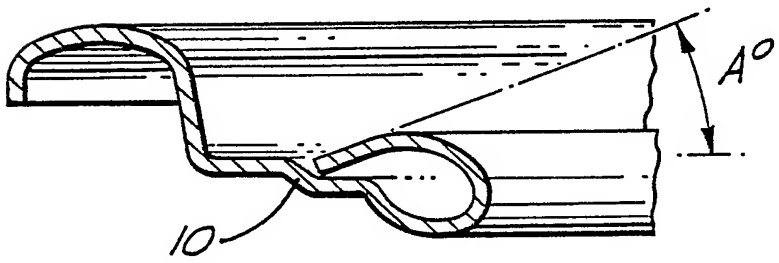


FIG. 10

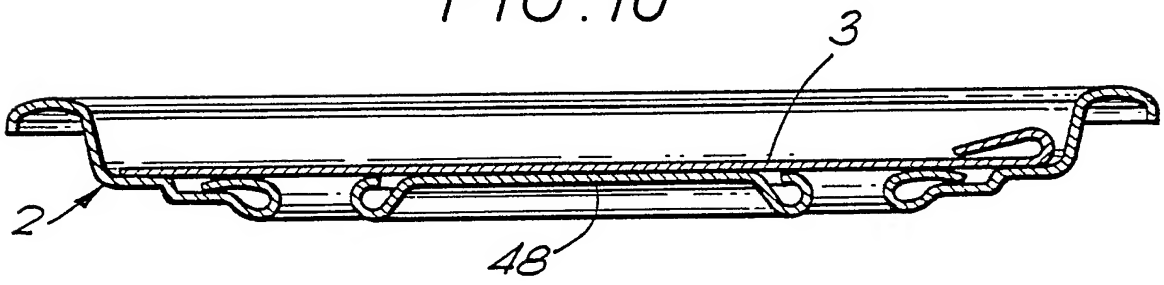


FIG. 8a

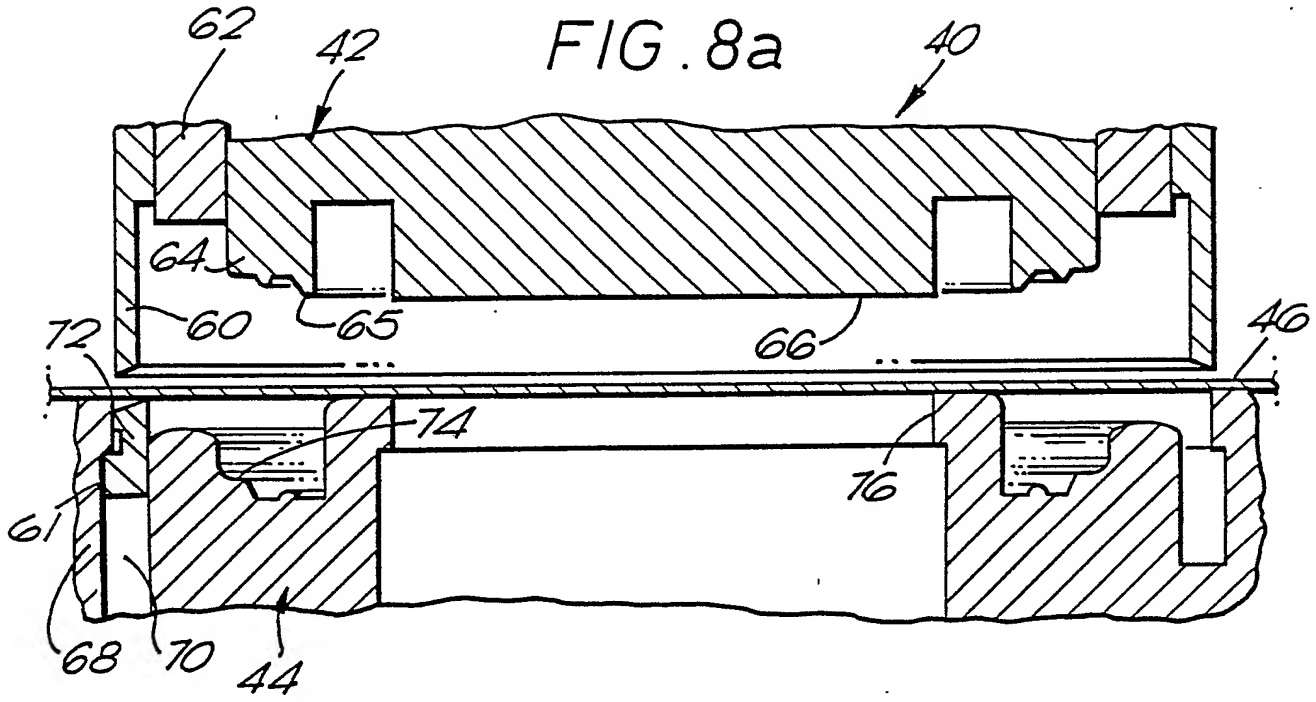


FIG. 8b

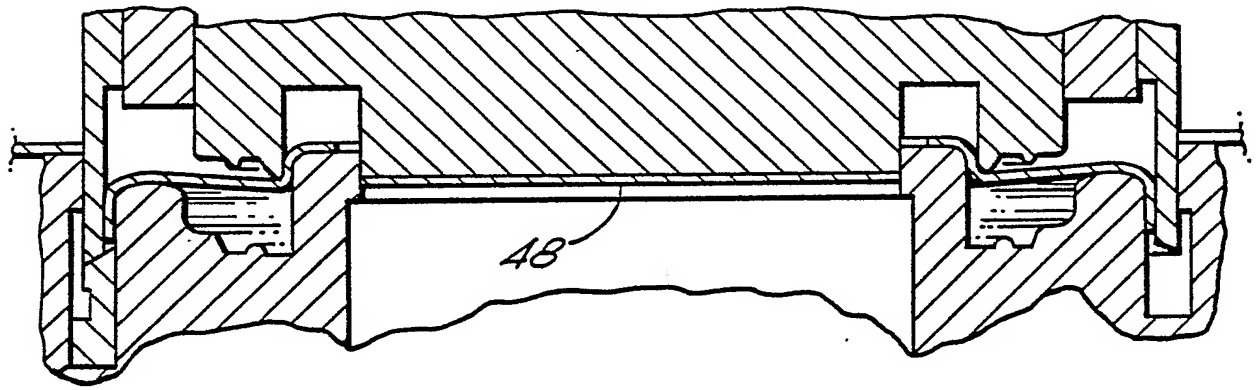


FIG. 8c

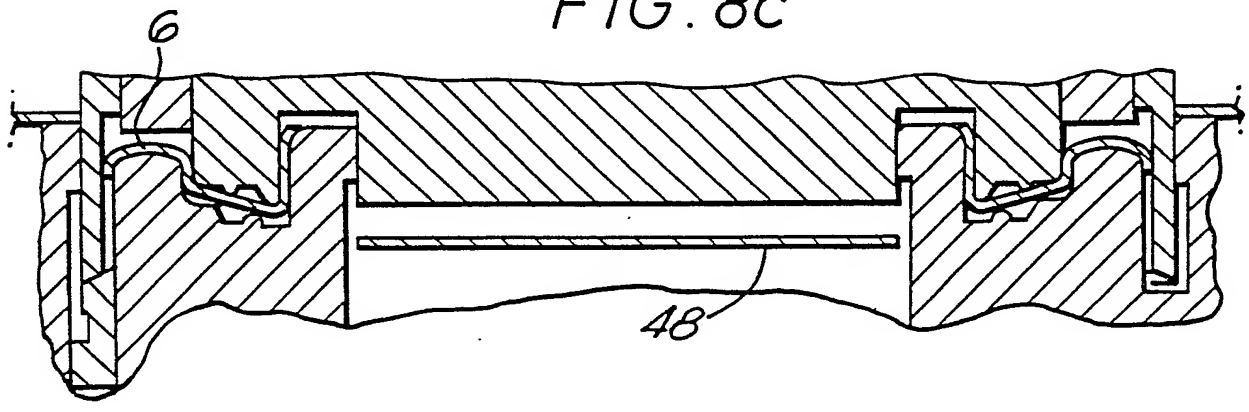


FIG. 8d

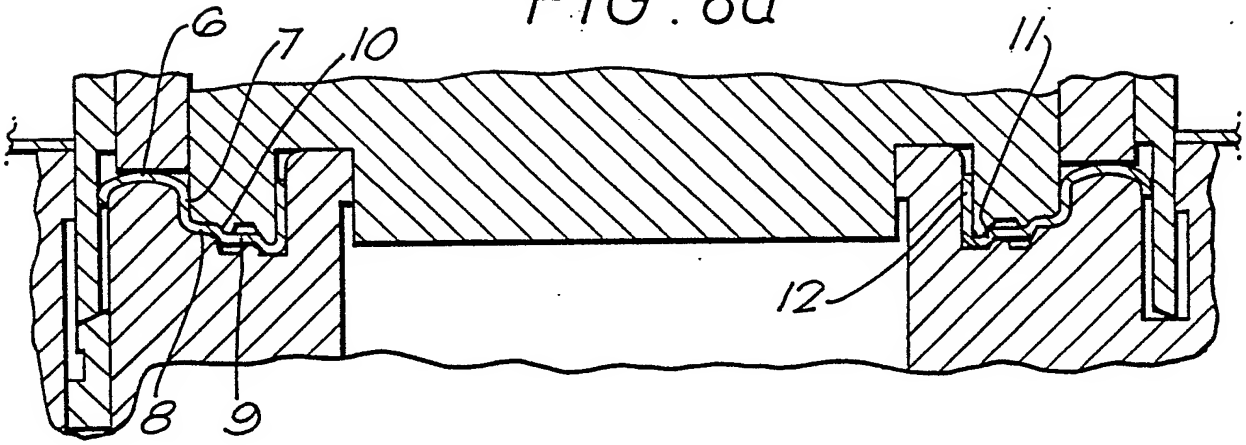


FIG. 8e

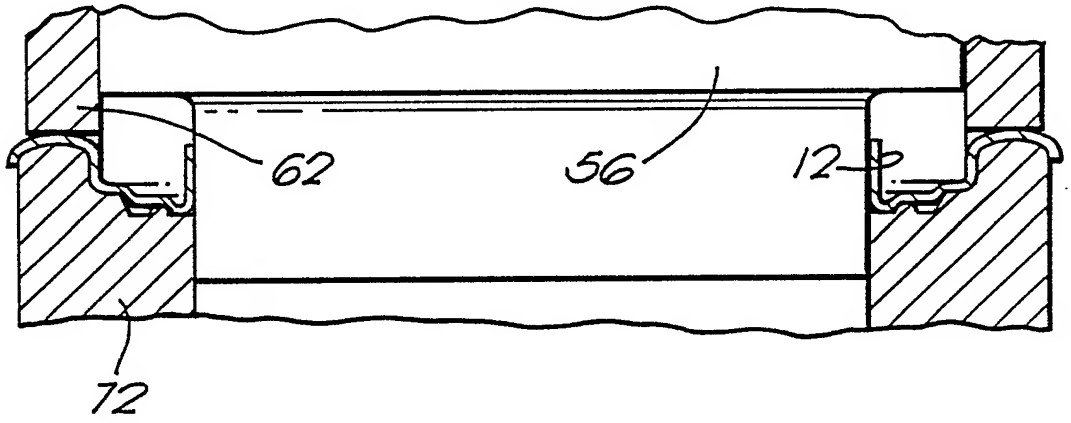
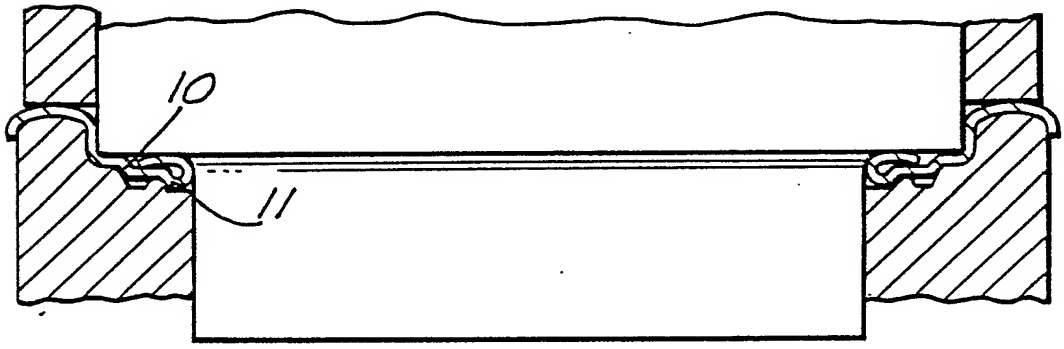


FIG. 8f



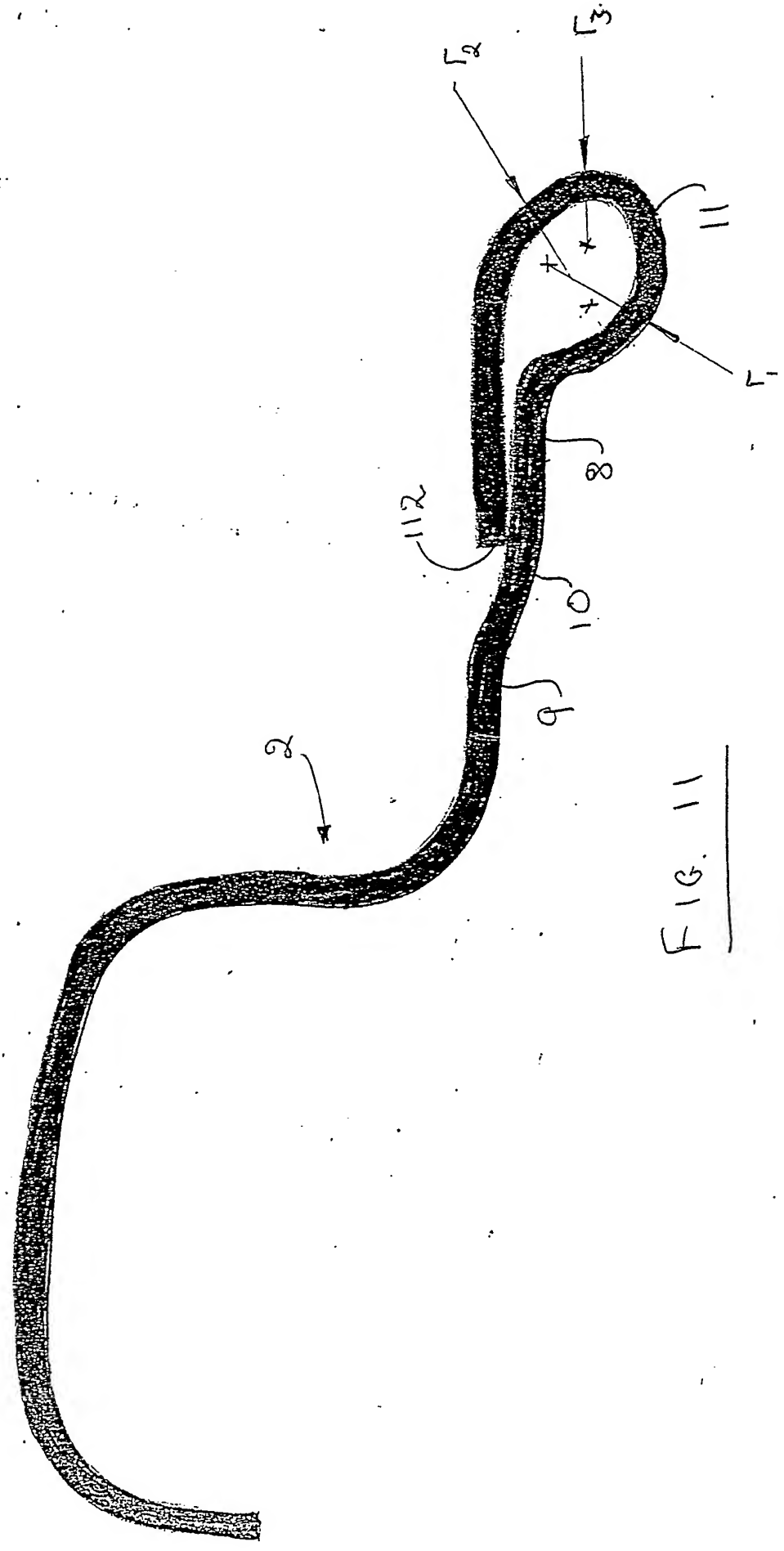


FIG. 1